

A Q U A P H Y T E

A NEWSLETTER ABOUT AQUATIC, WETLAND AND INVASIVE PLANTS

Center for Aquatic and Invasive Plants

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News from APIRS

By Karen Brown

The Aquatic Plant Information Retrieval System (APIRS) continues to grow, with the number of annotated records now exceeding 80,000. As longtime contributors to APIRS know, the database has been in service since the mid-1980s, providing access to the collective literature on aquatic plant species. The original mission of the database was to aid aquatic weed managers in developing countries. Problems included stranded villages, inaccessible fishing areas, impassable waterways, disease transmission, clogged reservoirs, weed-choked irrigation and drainage canals, and more. Initial APIRS funding was provided by the U.S. Agency for International Development (USAID). As the database grew to include a wider geographic range (worldwide) and a broader scope (riparian, wetland, salt marsh, macroalgae, some seagrasses, Florida mangroves, and more), the workload grew. Primary financial support shifted to the U.S. Army Corps of Engineers–Aquatic Plant Control Research Program (APCRP), the agency charged with maintaining federal navigable waterways, including weed control. One of Florida's own federal waterways, the St. Johns River, has a colorful history that includes the lavender flowers of water hyacinths (*Eichhornia crassipes*) covering the water surface from shore to shore. The University of Florida also supported one full-time position. Meanwhile, computer technology was evolving to enable easier and faster searches of the APIRS database. Original searches were performed in overnight batches at the University's regional data center, using complex Boolean search strings. Resultant bibliographies were printed and mailed to researchers. No fees were charged as the database grew largely from contributions of articles by researchers. We enjoyed colorful stamps from around the world and friendly correspondence from scientists, libraries and research institutions.

The advent of the Internet made the Center's website possible in 1995 and allowed online access to the database shortly thereafter. The commercial search software used was extremely expensive and required upgrades we were unable to afford. Search commands were still complex. Although access was now available to all, in reality, only two of us knew how to effectively search APIRS. By 2005 and with primary funding now coming from the Florida Fish and Wildlife Conservation Commission, Invasive Plant Management Section (previously the Florida Department of Environmental Protection, Bureau of Aquatic Plant Management), APIRS had become part of a broader range of services. Thanks to the creative energy of its founder, the late Vic Ramey, APIRS had been joined by an expansive website and many educational materials such as original video productions on aquatic plant identification and management, botanical drawings, photographs, and a companion website, [Plant Management in Florida Waters](#). A second companion website, the [Florida Invasive Plant Education Initiative](#), was developed to help school teachers introduce this topic to young students. To incorporate these expansions and clarify our larger purpose, we became known simply as the Information Office of the Center for Aquatic Plants. The Center, too, ultimately expanded to become the Center for Aquatic and Invasive Plants (CAIP), as invasive terrestrial (or upland) plants in Florida's public lands had grown to frightening proportions. In addition to our lakes, rivers and wetlands, gems such as Everglades National Park were threatened with loss of their native vegetation and alteration of ecosystem functions from encroachment of invasive plant species. Many seasoned aquatic biologists and natural resource managers shared their expertise and expanded their work into upland areas because the overall goal was the same—to control invasive plant infestations and protect natural resources. APIRS staff

See APIRS, continued on page 16.

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At the Center 2010–2011

By Dr. William T. Haller, Acting Director

The faculty and staff at the [UF/IFAS Center for Aquatic and Invasive Plants \(CAIP\)](#) were very active this past year conducting research and educational programs on invasive plant biology and control. Major cooperative programs are conducted with numerous partners including, but not limited to, the Invasive Plant Management section of the Florida Fish and Wildlife Conservation Commission (FWC), Osceola County, the St. Johns and South Florida Water Management Districts, and the U.S. Army Corps of Engineers Environmental Research and Development Center. A highlight in 2010 was the release of the *Aquatic Weed Control Best Management Practices* manual, edited by Dr. Gettys, Dr. Bellaud, and myself, and published by the [Aquatic Ecosystem Restoration Foundation \(AERF\)](#). More than 20 authors contributed chapters to the manual. The first printing of 12,000 copies is nearly depleted. The manual can be viewed or downloaded from the [CAIP](#) or [AERF](#) websites.

The CAIP was formed within the University of Florida's Agricultural Experiment Station by the 1978 Florida Legislature. The mission of the CAIP is to provide support and coordination to the UF Institute of Food and Agricultural Science (IFAS) faculty and staff working on developing environmentally-sound management practices for aquatic and natural area weeds. The CAIP is also responsible for extending information on the benefits of native plants and the impacts of invasive weeds to the public. This is accomplished by providing written information (edis.ifas.ufl.edu), online communication materials, and training courses.

The annual **Aquatic Weed Short Course** was presented in May 2011 in Coral Springs, FL with over 400 attendees. The course is designed in cooperation with the Florida Department of Agriculture and Consumer Services (FDACS) to provide Continuing Education Units (CEUs) to licensed pesticide applicators and provide basic training for those (>150) taking pesticide certification exams for the first time. The [Southeast Herbicide Applicators Conference \(SEHAC\)](#) is planned for North Florida (Panama City) in early October 2011. More conference information is available at the website.

The annual [PLANT CAMP](#) workshop for school teachers, produced by CAIP Education Initiative Coordinator Amy Richard, was held June 11–15 in Gainesville. Twenty-four teachers attended, representing school districts and environmental centers from around the state. PLANT CAMP is part of the CAIP's [Invasive Plant Education Initiative](#) that provides training, field experience, plant identification, interactive activities, communication materials, and full curriculum (that meets Florida's Sunshine State teaching standards) to teachers. They are encouraged to use the materials in their classrooms and share them with other teachers within their districts. PLANT CAMP is an extensive four-day expense-paid training course; teachers must apply and are selected based on subjects taught, previous experience, letters of recommendation, and more.

Graduate Students

Dr. Atul Puri completed his doctoral program at the CAIP and

has been working for DuPont in Wilmington, Delaware for several months. Graduate students Sushila Chaudhari and Courtney Stokes have completed their M.S. degrees and moved into Ph.D. programs at North Carolina State and Cornell University, respectively. Sarah Berger (M.S.), Brett Bultemeier (Ph.D.), and Abhishek Mukherjee (Ph.D.) are finishing their degrees this summer. Dr. Jeff Hutchinson completed his doctoral program and is now conducting research in a post-doctoral position with Dr. Ken Langeland.

New M.S. students include Leif Willey from Indiana working with Dr. Michael Netherland (Agronomy), and Kate Wilson, formerly of Washington State and Idaho, working with Dr. Tracy Irani in the Department of Agricultural Education and Communication on natural resource communication and outreach.

Faculty

The long-vacant Weed Ecologist position in the Agronomy Department, formerly held by Dr. Alison Fox (now retired), will be filled by Dr. Luke Flory this summer after he wraps up his post-doctoral responsibilities at Indiana University. Responsibilities for this position include teaching the "Biological Invaders" course and overseeing the [IFAS Weed Assessment Program](#), among other duties.

Dr. Taizo Uchida, Weed Ecologist and Associate Professor from Kyushu Sangyo University in Fukuoka City, Japan, will spend a six-month sabbatical at the CAIP from September 2011–March 2012.

We also expect to help Dr. Kevin Murphy and his graduate student in Gainesville in July 2011 as they conduct a worldwide survey of high pH or chalk streams. This will involve sampling many spring runs in North Florida, which will be a pleasant task in mid-summer.

Other Accomplishments

Amy Richard has taken the lead in representing the CAIP in developing the role and mission of the newly formed [North American Invasive Species Network](#). The purpose of this network, which includes invasive species centers in Mexico and Canada, is to provide greater access to, and coordination of, North American invasive species information and research activities.

From a personal standpoint, our several years of research with new aquatic herbicides has paid off nicely in 2010–2011 with the U.S. Environment Protection Agency's registration of flumioxazin (*Clipper*[™]) and bispyribac-sodium (*Tradewind*[™]) from Valent Corporation. The registration of several new aquatic herbicides in the past decade now provides us with several modes-of-action which will help in managing the potential development of herbicide-resistant populations of aquatic weeds.



Applications In Plant Invasions: A Short-Term Retrospective From A Center Newcomer

By Colette C. Jacono, Ph.D

On joining the Center in 2009, I might never have predicted the variety of problems and possibilities in plant invasions awaiting in Florida, nor imagined their broader-reaching effects on other beings and environments on our planet. Research projects in natural area wetlands have been my primary focus; however, the strong extension directive maintained by the Center has presented a wide conduit through which new invasion scenarios continue to be presented.

Under a research grant from the South Florida Water Management District, the agency that oversees water resources in the southern half of Florida, we are using seed storage and greenhouse regeneration trials to understand the early life history processes crucial to the establishment and persistence of Tropical American watergrass (*Luziola subintegra*). Although Neotropical in origin, the endemic distribution of this “rice-related” species is not clear because, based on botanical records, it has moved significantly in recent decades in the greater Caribbean Basin. Since its 2007 discovery in Florida, and despite a concerted regimen of herbicide treatment, Tropical American watergrass has spread in Lake Okeechobee, and invaded a restoration wetland on the eastern margin of Everglades National Park. We are learning how hydrology interacts with seed survival in the soil and with seedling regeneration in the colonization of new sites. At the same time we are identifying and monitoring the response of associated plant species at the Everglades site, in order to better guide restoration processes. These applied studies focused on providing immediate information needed by land managers to accurately predict population dynamics in conjunction with their ongoing herbicide applications for management purposes.



DNA “fingerprint” analysis was used to clarify the endemism of this water clover fern (*Marsilea*) which was previously considered introduced in central Florida.

Through research funding from the St. Johns River Water Management District, the agency responsible for water resources in northeast and east-central Florida, we are refining an integrated approach for the long-term control of Wright’s nutrush (*Scleria lacustris*) in seasonal wetlands. Our aim is to deplete the extensive seed bank existing in marsh soils while preventing continued seed

production in recurring populations. By timing significantly reduced herbicide dosage with plant growth stage, we can minimize non-target damage to native species while still achieving control of Wright’s nutrush. Our current recommendation was released this month as part of a fact sheet for resource managers (<http://edis.ifas.ufl.edu/ag352>). Such recommendations are based on extensive findings produced while I was with the United States Geological Survey and are detailed in the fact sheet.

The St. Johns River District also sponsored the final leg in our collaborative project with the Florida Museum of Natural History on the taxonomy of water clover ferns (*Marsilea*). We utilized DNA sequencing of several plastid regions to “fingerprint” *Marsilea* specimens from around the world in order to provide an identification and source of origin for unknown plants that have been expanding at several locales in central Florida. Molecular sequencing was expected to resolve not only the question of *Marsilea*’s endemism, but also whether weed management or conservation protection should be employed. Our results concluded the specimens are an undescribed species that is native in Florida and identical to a collection made over 100 years ago. Its return to the Emerald Marsh Restoration Area could reflect the restoration of more natural hydro periods in the greater Lake Griffin ecosystem as its occurrence can be expected to increase following events that open the vegetative canopy and incorporate fluctuation into surface waters.

Several important invasion scenarios have arisen through Center extension, all of which bear broad-reaching impacts. Aroma (*Dichrostachys cinerea* subsp. *africana*) has now been found at multiple sites in the Florida Keys and in central Florida. A thorny, thicket-forming Old World legume, Aroma is internationally recognized as a high-risk species for its invasive tendencies. In regions as near as Cuba, it is cited as an introduced weed of national significance. In Florida, two Cooperative Invasive Species Management Areas (CISMAs) are willing to contribute labor to tackle the thorny thickets; nevertheless, it is anticipated that the CISMAs will fall short of an eradication goal. Aroma has broad climate and soil suitability, fixes nitrogen, tolerates mutilation, and re-sprouts from the base as well as from extensive root structures and seeds. Little is known about its invasion ecology and management programs are non-existent. While our immediate efforts in obtaining grant funds for a joint eradication/research program have failed, we hope that such an effort will be forthcoming.

Applied science in the ecology of invasions is an increasingly pressing need as climates change and human exertions on the environment become more severe. The discovery of science-based solutions for invasion management hinge on our ability to apply ecological approaches to understanding why species interact as they do with their introduced environment. I only hope that closed budgets and tight belts will not diffuse mankind’s responsibility for alleviating his heavy footprint in the realm of plant invasions.

Colette C. Jacono, formerly a post-doctoral associate under Professor Ken Langeland at the Center for Aquatic & Invasive Plants, recently took a position with the U.S. Department of Agriculture in Gainesville.

Clearing a Trail for the Next Generation

By Amy Richard

For six years the UF/IFAS Center for Aquatic and Invasive Plants (CAIP) has been leading a concerted outreach effort for educators in Florida. The short-term goal of the [Florida Invasive Plant Education Initiative](#) is to raise awareness among upper elementary, middle, and high school teachers about invasive plants, and to inspire them to bring this important topic into their classroom and to fellow educators. The long-term goal is to bolster our next generation with tools and the desire to become responsible environmental stewards.

Toward this end, UF/IFAS CAIP collaborated with dozens of teachers to develop curriculum about aquatic and upland invasive plants in Florida. Several audio-visual presentations and a host of learning materials have been developed for use in the classroom as a result. The on-going project has been made possible through a collaborative effort of CAIP and the Invasive Plant Management Section of the Florida Fish and Wildlife Conservation Commission (FWC).



PLANT CAMP participants visit Lake Tohopekaliga (Toho) in Osceola County—a “quintessential” multiple-use Florida waterbody that supports eco-tourism (airboat and birding tours); bass fishing, and duck hunting, while also serving as a federal flood control project. The arrival of endangered snail kites a few years ago further complicated large-scale hydrilla management. The snail kites depend on an invasive apple snail for food, which in turn feeds on the invasive aquatic plant, hydrilla.

A major component of the Education Initiative is an annual invasive plant teacher-training workshop, one of the first of its kind in the country, hosted by CAIP and FWC each June. The 5-day [PLANT CAMP](#) workshop includes field trips, rigorous hands-on plant identification activities, and classroom lectures—all designed to provide teachers with greater background knowledge and first-hand experience with large-scale invasive plant infestations. More than 160 teachers have been formally trained at these events.

Recently, the CAIP outreach team developed an evaluation instrument to determine the effectiveness of these efforts. In August 2010, the survey was distributed among former participants to de-

termine (1) if they are using their training and materials, and (2) if they experienced an increased awareness, understanding, and acceptance of the plant management practices they learned about during their training and use of materials.



PLANT CAMP participants compete in a hands-on plant identification quiz to sharpen their observation and identification skills.

The following highlights are encouraging:

- Nearly 85% of respondents have been teaching their students about invasive plants since they received training, representing a 47% gain from those who taught the subject before receiving training. The same gain was achieved with regard to teachers training fellow teachers.
- 98% of respondents agreed (i.e., “agree” and “strongly agree” combined) they are now more aware of the need to manage invasive plants.
- Nearly 97% say the workshop made them more aware of the high financial costs of managing aquatic invasive plants.
- As a result of their learning, 66% of respondents agreed (i.e., “agree” and “strongly agree” combined) the use of herbicides is necessary.
- Even higher percentages of respondents agreed that biological, mechanical and physical control methods were necessary—over 83% for each.
- More than 90% “strongly favored” and “somewhat favored” (combined) physical control methods.
- Nearly 13% “strongly oppose” the use of chemical control.
- Biological control and mechanical control both received favorable responses from more than 85% of respondents.
- [PLANT CAMP](#) graduates have trained or introduced the topic of invasive plants to an estimated 1,169 teacher-colleagues and an estimated 17,679 students as a result of these efforts.

Amy Richard is Coordinator of the Education Initiative at the Center for Aquatic & Invasive Plants.

Adding to the restoration toolbox: identifying widely adapted biotypes of eelgrass

By Lyn Gettys, PhD

Many lake restoration projects begin with the removal of invasive plants, muck, and accumulated detritus. The resulting habitat is often devoid of submersed aquatic vegetation, thereby lacking the underwater plant communities needed to provide ecosystem functions such as structure for fish and other aquatic animals. Therefore, an important part of many lake restoration projects is the introduction of native submersed plants. Most restoration ecologists agree that the best plant material for these projects is vegetation collected from areas near the restoration site. However, this is not always feasible for a number of reasons. For example, there may not be adequate source populations of suitable plants near the restoration site, or conditions at nearby sites may be quite different from the lake targeted for restoration. As a result, it may be necessary to obtain plant material from other sources.

Eelgrass (*Vallisneria americana*) is widely used in Florida lake restoration projects because the species is a native submersed perennial plant that grows in water up to 10 feet deep. It also tolerates a wide range of environmental conditions, including low light levels. The majority of naturally occurring populations of eelgrass are found in lakes with sandy, nutrient-poor sediments; however, many lakes targeted for restoration have sediments that are mucky and high in nutrients. A number of restoration projects have been unsuccessful because, despite significant inputs in labor and plant material, self-sustaining populations of eelgrass failed to become established. Therefore, it is important to use plant material that is

adapted to the less-than-ideal conditions at many restoration sites to increase the likelihood of successful establishment of newly planted vegetation.

Here at the Center, we are currently conducting a screening program to identify biotypes (similar to botanical varieties) of eelgrass that tolerate and thrive in sediments with high levels of organic material and nutrients. Plants are grown under “common nursery” conditions in sediment types ranging from pure sand to pure peat, and under nutrient levels ranging from none to high (4 g of controlled-release fertilizer per liter of sediment). We have evaluated plants from commercial sources and from a number of lakes throughout Florida where populations of eelgrass naturally occur. Some of these lakes have the sandy, nutrient-poor sediments typically preferred by eelgrass, but others have mucky, nutrient-rich sediments. We have thus far identified several biotypes of eelgrass that are highly productive regardless of sediment conditions. One of these biotypes is from a commercial source, but the others are field-collected plants from Florida lakes (including Lakes Seminole and Okahumpka) with the “hostile,” mucky, nutrient-rich conditions common at many lake restoration sites. These widely adapted biotypes of eelgrass may be very useful in lake restoration projects and give restoration managers another tool to increase revegetation success at sites where most eelgrass fails to establish.

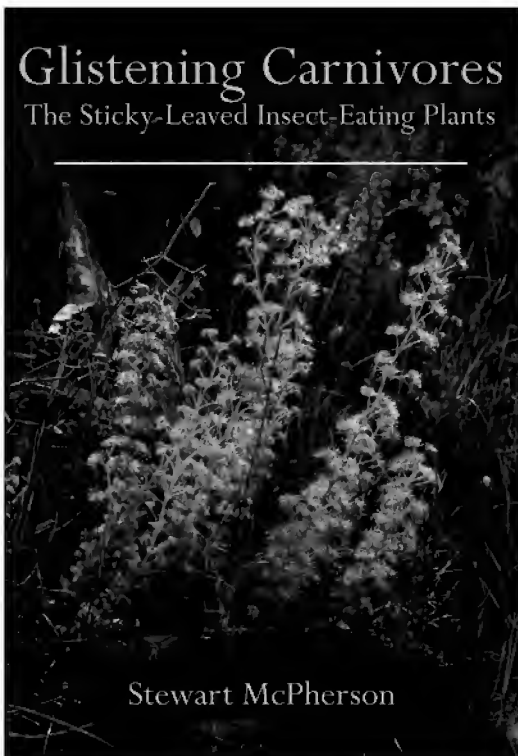
Lyn Gettys is a Research Assistant Scientist at the Center for Aquatic & Invasive Plants.

*The native submersed plant, *Vallisneria americana*, in Lake Okeechobee, Florida. Most of the eelgrass disappeared from this lake a number of years ago but volunteer populations began to appear after hurricanes in 2004 and 2005.*

Photo by Kate Wilson, May 2011.



BOOKS/REPORTS, ETC.



GLISTENING CARNIVORES—THE STICKY-LEAVED INSECT-EATING PLANTS
By Stewart McPherson. 2008. 392 pp. ISBN 978-0-9558918-1-6. Redfern Natural History Productions. www.redfermnaturalhistory.com

No less than 278 color photographs illustrate this unfettered book that describes the seven genera of sticky-leaved insect-eating plants (*Byblis*, *Drosera*, *Drosophyllum*, *Ibicella*, *Pinguicula*, *Roridula* and *Triphyophyllum*). Ethnobotanical uses and botanical history are reported throughout, with extensive and numerous excerpts from historical and modern sources, especially Charles Darwin, to whom the book is dedicated and whose work on insectivorous plants is documented in the first chapter. According to the author, Darwin's "meticulous studies first established the carnivorous nature of *Drosera* and other sticky-leaved plants." Other references provide such entertaining gems as "...much esteemed by medieval alchemists and herbalists who claimed that it would burn off warts and excite lust in cattle." Of particular interest was the story of Carolus Linnaeus who, upon receiving a sketch of the trap of *Dionaea muscipula* together with plant material (1769), responded that the idea of an insect-eating plant was "...ridiculous and that it was contrary to the God-given rules of nature." He reportedly referenced Genesis I, 29–30 and declared the notion blasphemous. Charles Darwin published his own book, *Insectivorous Plants*, more than 100 years later (1875). *Glistening Carnivores* reads like a personal journal of the daily explorations and nightly readings of a scientist singularly obsessed with these fascinating plants. And no wonder!

A GUIDE TO THE CONTROL AND MANAGEMENT OF INVASIVE PHRAGMITES – SECOND EDITION

By B. Avers, R. Fahlsing, E. Kafcas, J. Schafer, et al. 2009. 38 pp. Michigan Department of Natural Resources, U.S. Fish and Wildlife Service. Available as a

PDF file from www.michigan.gov See DNR, Wildlife & Habitat, Plant Species.

"An aggressive, nonnative variety of phragmites (*Phragmites australis*), also known as common reed, is threatening the ecological health of Michigan wetlands and coastal shorelines. This invasive variety of phragmites is becoming widespread throughout the Great Lakes and is displacing the native variety of the same species, as well as many other native plants." The goal of this guide is to provide information about effective methods to control and manage *Phragmites*. Because the guide discusses tools that are not typically applied by the average landowner, it is intended primarily for land or resource managers from agencies, professional organizations, and businesses; extension agents; or others in a similar profession. Control methods are described and include herbicide treatments, prescribed fire, mechanical treatment, and water level management (flooding). Three management strategies are described, and long-term management and monitoring are discussed.

A BOOK OF REED (*PHRAGMITES AUSTRALIS* (CAV.) TRIN. EX STEUDEL, FORMERLY *PHRAGMITES COMMUNIS* TRIN.)

By S.M. Haslam. 2010. 261 pp. ISBN 978-0-9564692-0-5. Forrest Text, Cardigan, UK.

This esteemed author considers common reed a remarkable plant and thoroughly explores its life history, pattern and growth, genetic and clonal variations, and physical and economic impacts. We are told that "Because of its cosmopolitan distribution, its fascinating biology, its uses to people and its responses to so many habitat factors, *Phragmites* is indeed a plant worth studying and reading about." This book is your opportunity to do just that.

A SELECTION OF PLANTS FOR GREENING OF WATERWAYS AND WATERBODIES IN THE TROPICS

By J.W.H. Yong, T.P. Yok, N.H. Hassan, and T.S. Ngin (eds.) 2010. 480 pp. ISBN 978-981-08-5086-9. National Parks Board, Nanyang Technological University, Public Utilities Board, Singapore.

This book is a practical guide to using aquatic plants in urban settings, including landscaped ponds, planted edges of stormwater sedimentation basins, naturalisation of canals and river banks, constructed wetlands, "cleansing biotopes" and floating vegetated islands in reservoirs or waterways. The book is luxuriantly illustrated with color photographs of the various applications for greening waterways and waterbodies, and of the 114 plants selected and grouped by type (rheophytes, floaters, floating-leaf plants, submerged and emergent plants, and mangroves and other plants of coastal habitats). It aims to reach a diverse audience, including urban planners, hydrological engineers, architects, landscape designers, and horticulturists. The book is part of a larger effort to develop a "Periodic Table of Plants" that will serve as a reference to plants best suited to absorbing chemical elements or compounds from the environment. Where pollutant uptake (phytoremediation) capacity for specific plants is known, the relevant information has been included in the plant descriptions.

Phytoremediation includes the removal of nutrients, heavy metals, metalloids, pesticides, hydrocarbon, organics and endocrine disruptors. This book is informative, attractive, and interesting, and serves as an enticing invitation to visit Singapore to view this work in progress.

IDENTIFICATION GUIDE FOR INVASIVE PLANTS IN SRI LANKA

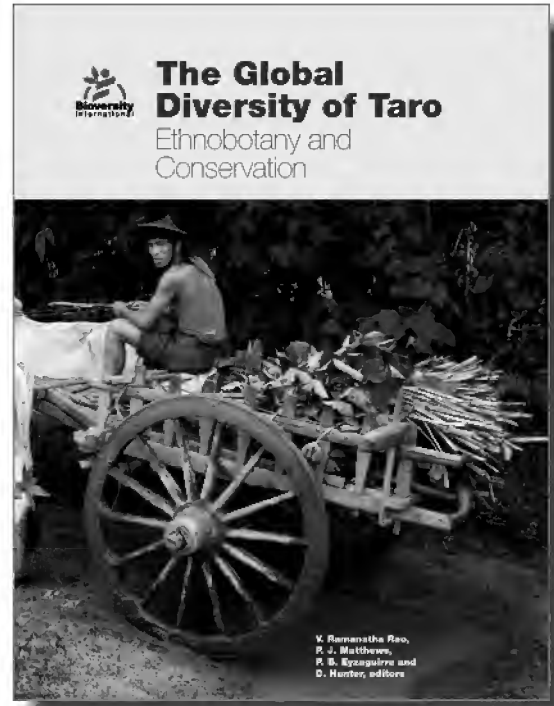
By Lalith Gunasekera. 2009. 125 pp. ISBN 978-0-646-51489-5. <http://www.sarasavi.lk/>

The main objective of this book is to improve public knowledge, awareness, and identification of the most invasive plants in Sri Lanka. The book covers invasive plants in aquatic, agricultural, natural, and forest ecosystems.

THE GLOBAL DIVERSITY OF TARO—ETHNOBOTANY AND CONSERVATION

By V. Ramanatha Rao, P. J. Matthews, P. B. Eyzaguirre and D. Hunter (editors)

This book begins with a consideration of taro's history as a food and then travels from Ghana, through Indonesia, Vietnam, China and Cuba, finally finishing up in the Pacific Region. Taro is one of the world's oldest food crops, dating back over 9,000 years. First domesticated in Southeast Asia, it has spread throughout the world and is now an important crop in Asia, Pacific, Africa and the Caribbean. Farmers and communities have depended on taro cultivation to meet their daily needs for millennia and have nurtured and adapted the crop. However, they face many risks because of taro's vulnerability to biotic and abiotic problems, and global climate change. Worldwide, taro ranks fourteenth among staple vegetable crops with approximately 12 million tons produced globally from about 2 million hectares, with an average yield of 6.5 t/ha. (FAOSTAT 2010 estimates). Taro is also a sacred plant in many cultures, with high prestige and strong cultural and symbolic importance. This book on taro is among the first to offer a global approach, covering all regions, disciplinary perspectives and uses of the plant. Contributors from different disciplines and geographic regions offer a multidisciplinary and evolutionary perspective on taro that shows how one of the world's oldest domesticated plant species continues to evolve and acquire new uses. The book also demonstrates how the story of taro can serve as a model for the in situ conservation and use of a staple crop whose global importance is evidenced at the local level in traditional food systems, and not in global commodity markets or trade. The book may be downloaded as a PDF file at <http://www.biodiversityinternational.org/publications.html> or requested via e-mail at: biodiversity-publications@cgiar.org



CRYPTOCORYNE OF PENINSULAR MALAYSIA

By A.S. Othman, N. Jacobsen, and M. Mansor. 2009. 102 pp. ISBN 978-983-861-377-8 (hard cover), -4 (soft cover). University Sains Malaysia Press, Pulau Pinang.

"The aquatic and amphibious genus *Cryptocoryne*, popularly known as Water Trumpet, is a very characteristic plant component when you visit the forest streams in Peninsular Malaysia, where each species in shape, size, and flowering is adapted to exactly those circumstances under which it is found in the forests. The ultimate experience is when you explore the forests and come upon a stream which is fully covered with leaves of a *Cryptocoryne* species.... The book is the result of many years of research and cooperation regarding the Water Trumpets of Peninsular Malaysia." These charismatic plants are popular among aquarium enthusiasts due to the variable shapes and attractive colors of their foliage. They are entomophilous (pollinated by insects), with male and female flowers hidden within a "kettle". Chapters include an overview of the genus, morphology and cytology, evolution of the genus (using evidence from chromosome numbers and molecular DNA analysis), and systematic treatment, as well as a discussion of the conservation needs for each species. Although some photographs are less than sharp, the book is nicely illustrated overall with color images of the species.

NEW JOURNAL

Inland Waters: Journal of the International Society of Limnology is a new, international, peer-reviewed journal for original papers that advance our understanding of inland aquatic ecosystems and their management.

Inland Waters replaces the SIL (**International Society of Limnology** [formerly International Association of Theoretical and Applied Limnology; Societas Internationalis Limnologiae, SIL]) Proceedings (Verhandlungen), but will remain as faithful as possible, with encouragement of a worldwide set of authors and short (except for papers arising from named and plenary talks at Congresses), rapidly-published papers. The scope of the journal includes all aspects of physical, chemical, and biological limnology, as well as applied and regional limnology. Publication in the journal is not restricted to SIL members.

Inland Waters is an "online first" journal, publishing papers online as they are accepted, and then in four print issues per year. The first issue was published in April 2011. The journal is available through membership of SIL, with free online access to SIL members, and by subscription. Visit www.limnology.org

MARY'S PICKS

Items of special interest from APIRS reader/cataloger, Mary Langeland ~

Blanco, S. & Ector, L. (2009) Distribution, ecology and nuisance effects of the freshwater invasive diatom *Didymosphenia geminata* (Lyngbye) M. Schmidt: a literature review. *Nova Hedwigia* 88:347–422

Didymo, short for *Didymosphenia geminata*, is an invasive microalgae with massive proliferation, which forms conspicuous growths in streams. In this bibliographic study, according to Blanco and Ector, “a near exhaustive investigation was performed in the scientific literature, phycological inventories, technical reports and internet databases” to account for present records. “This paper investigates the historic and current biogeographic range of this invasive species (and varieties) based on 1,000 citations collected mainly from the scientific literature. The locations where this diatom has appeared, including both fossil and recent records, are presented in world distribution maps. Our results confirm that the native range of *D. geminata* is almost restricted to the Holarctic region, though its distribution area is broader than usually reported in the literature. The ecological profile of this alga, along with its nuisance effects, is also discussed.”

Chaplin, G.I & Valentine, J.F. (2009) Macroinvertebrate Production in the Submerged Aquatic Vegetation of the Mobile-Tensaw Delta: Effects of an Exotic Species at the Base of an Estuarine Food Web. *Estuaries and Coasts* 32(2):319-332

Chaplin and Valentine report the first estimates of the effects of the proliferation of *Myriophyllum spicatum*, an exotic submerged aquatic vegetation (SAV) species, on macroinvertebrate production in the Mobile-Tensaw Delta, a tidally influenced estuary of the northern Gulf of Mexico. They do this by comparing the secondary production occurring on two native SAV species, *Heteranthera dubia* and *Vallisneria americana*.

Annual macroinvertebrate production of crustaceans, gastropods, bivalves and insect larvae on these three dominant SAV species was estimated. Production was greatest on *M. spicatum* and *H. dubia* and least on *V. americana*; however, the researchers report that the production on *M. spicatum* was three times greater than on either of the two native SAV species.

Regarding this high productivity on a non-native plant, the authors say, “From this limited comparison made within a single trophic level, it could be argued that the spread of *M. spicatum* within the Mobile-Tensaw Delta is one example of an exotic species benefiting an open coastal ecosystem... we believe that assessments of the impacts of exotic SAV species on coastal food webs, including our own, remain too simple and that there is a need to make these assessments from a broader perspective.”

The authors conclude: Based on no-choice palatability tests, it is probable that the high production within the structurally complex *M. spicatum* and *H. dubia* was the result of reduced predator foraging efficiency. Thus, they contend that “it is premature to conclude that the extraordinary production measured on *M. spicatum* is responsible for the persistence of higher order consumers in the Delta food web.”

Coates, C. (2009) Aquatic Plants Surviving in the Acidic Lakes of the Ocala National Forest. *Aquatics* 31(2):15-16

The Ocala National Forest sits atop ancient sand dunes that played a key role in the development of 600+ highly acidic lakes that are unique to this national forest. Coates states, “... the lakes with pH ranges between 4.1 and 4.4 are of particular interest and have been classified by the Forest Service as highly acidic.” Lakes Clay, Gobbler, Mary and Lawbreaker have pH values of 4.4, 4.1, 4.4 and 4.3, respectively. Factors contributing to the acidity of the lakes include surface water as the sole source of recharge; three of the lakes are seepage lakes with no stream flow into or out of them; and, lack of natural buffering.

One effect of the acidic water is to slow the decomposition rate of organic matter, reducing nutrients available for plants. Nonetheless, according to Coates, “In the lakes of the Ocala National Forest aquatic plants survive and even thrive in these highly acidic conditions,” including *Fuirena scirpoidea* (rush fuirena), *Leersia hexandra* (southern cut grass), *Nuphar luteum* (spatterdock), *Utricularia floridana* (Florida yellow bladderwort), *Utricularia purpurea* (eastern purple bladderwort), *Panicum hemitomon* (maidencane), *Nymphaea odorata* (fragrant water lily), and *Websteria confervoides* (algal bulrush).

The author says further questions remain: Are the pH levels in these lakes stable or are the levels slowly decreasing? If they are decreasing, what are the implications? When the pH level in a lake reaches 4.3 or lower, aquatic plant coverage and species diversity appear to decline. If that is the case, at what pH level does aquatic plant life disappear? Will the lakes of the Ocala National Forest ever reach that point?

Meyerson, L.A, Voila, D.V., & Brown, R.N. (2010) Hybridization of Invasive *Phragmites australis* with a Native Subspecies in North America. *Biol. Invasions* 12(1):103-111

Both native and introduced lineages of *Phragmites australis* occur in North America so there is an excellent opportunity to investigate intraspecific hybridization. According to Meyerson et al., “The major goals of this research were to demonstrate coincident flowering phenologies of multiple populations of native and introduced *Phragmites* collected from a broad geographic range and to prove that hybridization between the native and introduced strains of *P. australis* was indeed possible.”

The authors report for the first time in this article, “that native and introduced populations of *Phragmites* can hybridize. There is substantial overlap in flowering period between native and introduced populations from the same geographic locations.”

Their “data demonstrates the ability of the native and introduced lineages to interbreed, but successful crosses were highly dependent on the identities of the parent populations. Furthermore, only crosses with introduced *Phragmites* pollen donors and native recipients exhibited seed set, suggesting gene flow is unidirectional.” Nonetheless the concern is, “If hybridization is occurring in the field, it will undoubtedly lead to further declines of the native subspecies through genetic swamping and, potentially, through increased competition if hybrids exhibit increased vigor.”

Joyeux, M., Vincent, O. & Marmottan, P. (2011) Mechanical Model of the Ultrafast Underwater Trap of *Utricularia*. *Physiological Review* E83, 021911

Joyeux et al. offer a fascinating look at the mechanism enabling the underwater traps (bladderlike organs) of bladderworts to catch their prey. The model they propose combines two phases: repetition of an “active slow deflation followed by passive fast suction” sequence.

During the first, slow step, the door is indeed closed and the concave wall curvature, due to the lower internal pressure, results in elastic energy being stored in the walls. The second, ultrafast step begins when a potential prey touches one of the trigger hairs and is engulfed when the walls of the trap release the stored energy. Both experimental results and theoretical models are presented in an effort to understand this mechanism. A combination of high-speed video imaging, scanning electron microscopy, light-sheet fluorescence microscopy, particle tracking, and molecular dynamics simulations was used to visualize the motion of the door and propose a plausible mechanism.

The authors propose a mechanical model that describes both phases and strongly supports the hypothesis that the trap door acts as a flexible valve that buckles under the combined effects of pressure forces and the mechanical stimulation of trigger hairs, and not as a panel articulated on hinges.

Nesom, G.L. (2009) Assessment of Invasiveness and Ecological Impact in Non-Native Plants of Texas. *J. Bot. Res. Inst. Texas* 3(2):971-991

Nesom’s method, titled “Fundamental Invasiveness Index”, serves as a framework for assessment and ranking of each of the non-native species of Texas according to their invasiveness and ecological impact. The Index is based on knowledge of the species from field, herbarium, and literature, according to four criteria:

F1: Invasive in both disturbed and natural habitats, negatively affecting native species or natural biodiversity by altering native vegetation and habitats or by outcompeting or hybridizing with native species; or, invasive into agricultural habitats and causing significant economic damage; including woody, herbaceous, and aquatic species.

F2: Abundant in number and widespread; commonly invasive in disturbed habitats, much less commonly in natural habitats; subdivided into woody, herbaceous, and aquatic species.

F3: Relatively few in number, known from relatively few localities, usually in disturbed habitats; subdivided into woody and herbaceous species.

F4: Status unknown.

The 812 non-native species growing outside of cultivation in Texas have been documented. A preliminary list of non-native species in Texas was developed by the author from the USDA PLANTS Database. Journals and other literature were reviewed for possible additions, and, he notes, a number of species were excluded. “Only plants that are naturalized have been included in the assessment.” Nesom’s method “emphasizes simplicity, allowing assessment of the large number of non-native species (all that are known to occur in the state).” Of the entire list, 25 are aquatic (9 classified as F1, 16 classified as F2). Four Appendices list the plants and their rankings, including a Watch List with

a section of “Potential and expanding new arrivals with global warming in south and coastal Texas.”

Pemberton, R.W. & Bodle, M.J. (2009) Native North American *Azolla* Weevil, *Stenopelmus rufinasus* (Coleoptera: Curculionidae), Uses the Invasive Old World *Azolla pinnata* as a Host Plant. *Fl. Entomol.* 92(1):153-155

Azolla pinnata, a tiny aquatic fern native to a large area of the tropics, subtropics, and warm temperate regions of Africa, Asia, and Australia, was found to be naturalized in waterways of southern Florida near Jupiter, in May 2007, by Bodle. The fern is classified as a Federal Noxious Weed and was found to be naturalized in North Carolina in 1999, where it continues to persist.

Pemberton and Bodle contend that “because of the difficulty in eradicating *A. pinnata*, it is prudent to consider other potential control approaches. Biological control appears feasible for a number of reasons.” Two insect herbivores are *Azolla* specialists in North America: one is a flea beetle, *Pseudolampsis guttata* (LeConte), occurring in the eastern U.S. and using *A. caroliniana* as its host plant; the other is a weevil, *Stenopelmus rufinasus* Gyllenhal, occurring in the western and southern U.S.

According to the summary, the native weevil, *Stenopelmus rufinasus*, a specialist herbivore on North American mosquito ferns (*Azolla* spp.), has adopted *Azolla pinnata*, an incipient invasive weed in Florida from the Old World. This situation, in which a weed has invaded the native area of a successful biological control agent of a congeneric weed in another region, is unique. Should *A. pinnata* escape eradication, *S. rufinasus* may prove useful as a control agent.

Pipalova, I, Kvet, J. & Adamek, Z. (2009) Limnological Changes in a Pond Ecosystem caused by Grass Carp (*Ctenopharyngodon idella* Val.) Low Stocking Density. *Czech J. Animal Sci.* 54(1):31-45

Pipalova, Kvet and Adamek looked at direct and indirect consequences of stocking a pond with grass carp. No previous studies used real control ponds. The purpose of this experiment “was to identify (1) changes in nutrient concentrations particularly of phosphorous and nitrogen in the water and sediment; and (2) changes in phytoplankton, zooplankton and zoobenthos biomass and abundance after a moderate stocking rate of grass carp in a small and shallow pond.”

The study was conducted at the experimental facility of the Research Institute of Fish Culture and Hydrobiology in the Czech Republic, from 1998 to 2000. Direct consequences of grass carp stocking on the biomass of aquatic macrophytes was measured in a pond, resulting in the biomass of *Cladophora globulina*, *Eleocharis acicularis* and *Potamogeton pusillus* being significantly decreased. *Cladophora* biomass was impacted the most. Indirect consequences of grass carp stocking on water chemistry were limited, with only the concentration of nitrogen increasing significantly. This was also true of sediment nutrients. The authors conclude that “the changes in water and sediment chemistry were greater in the pond without grass carp due to the presence and subsequent dieoff of the filamentous alga *Cladophora globulina* and thus the changes caused by grass carp stocking were not statistically significant.”

See Mary’s Picks, continued on page 14.

FROM THE DATABASE

The APIRS database now contains more than 80,000 annotated citations to the aquatic and wetland plant literature and to the literature on invasive species in Florida. The database is created from the contributions of researchers, and is used by researchers, worldwide. A small sample of recent additions to the APIRS collection is provided below. References cited include peer-reviewed research articles, government reports, books and book chapters, dissertations and theses, and gray literature such as abstracts from proceedings. To obtain full-text of citations, contact your nearest academic library or search online. <http://plants.ifas.ufl.edu/APIRS/>

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MARY'S PICKS *continued from page 9.*

Riefner, R.E. & Smith, A.R. (2009) *Salvinia minima* and *S. oblongifolia* (Salviniaceae) New to California, with Notes on the *S. auriculata* Complex. *J. Bot. Res. Inst. Texas* 3(2):855-866

The authors report the first documented occurrence of *Salvinia minima* and *S. oblongifolia* in California and also review the range, ecology, reproduction, potential invasiveness, mode of introduction, and likely pathways of dispersal. In addition, *Salvinia molesta*, previously found in California and known as one of the world's worst aquatic weeds, is re-examined using venation patterns, and its presence in the state is confirmed. A key for identification of sterile material of species of *Salvinia* in California is provided.

Although *S. molesta* and other species from the *S. auriculata* complex (exhibiting the recognizable "egg beater" shaped hairs) are listed as Federal Noxious Weeds and their importation prohibited, "... the continuing growth of internet sales and demand for the water-garden industry will increase the likelihood that species of *Salvinia* will continue to be introduced by cultivation and escape to California's urban and wildland wetland habitats."

Tipping, P.W., Center, T.D., Sosa, A.J. & Dray, F.A. (2011) Host Specificity Assessment and Potential Impact of *Megamelus scutellaris* (Hemiptera: Delphacidae) on Waterhyacinth *Eichhornia crassipes* (Pontederiales: Pontederiaceae). *Biocontrol Sci. and Technol.* 21(1):75-87

Eichhornia crassipes, the aquatic weed having perhaps the greatest socio-economic impact worldwide, was evaluated for biological control by the delphacid, *Megamelus scutellaris*. The insect was evaluated under quarantine conditions for host specificity including no-choice, two-choice, nymph transfer, and sustainability tests. Survival and development of adults and nymphs was the primary metric used for determining host suitability because feeding scars are inconclusive. To determine the fundamental host range of *M. scutellaris*, 69 plant species were tested: 27 were native, 5 were exotic, and 11 were economically important species.

After conducting no-choice and choice tests, nymph transfer tests and impact tests, it was determined that *Megamelus scutellaris* exhibited a high level of oviposition and developmental fidelity to *E. crassipes*. The insect was not able to sustain populations on any test plant past the F1 generation.

The authors conclude *M. scutellaris* is sufficiently host-specific and therefore can be safely released on *E. crassipes* in the United States. The insect significantly stressed *E. crassipes* under artificial but conservative testing conditions, demonstrating its potential to augment the suppressive effects caused by the existing biological control agents in the U.S. The USDA Animal Plant Health Inspection Service issued a general release permit for *M. scutellaris* in February 2010 and releases have been conducted in selected locations.

Van de Wiel, C.C.M., Van der Schoot, J., Van Valkenburg, J.L.C.H., Duistermaat, H. & Smulders, M.J.M. (2009) DNA Barcoding Discriminates the Noxious Invasive Plant Species, Floating Pennywort (*Hydrocotyle ranunculoides* L.f.), from Non-Invasive Relatives. *Molecular Ecology Resources* 9(4):1086-1091

There is great interest in using DNA barcoding for identifying plants and standardizing a protocol to barcode plants, especially known invasives. At ports of entry, should a protocol be developed and widely available, one would be able to unequivocally distinguish the invaders from related, non-invasive species. Toward that end, the authors show "that it is possible to distinguish *H. ranunculoides* from a series of closely related congeners by using a single plastid DNA sequence, *trnH-psbA*."

For this study the invasive plant, *Hydrocotyle ranunculoides*, was chosen because of the problems it causes to waterways in the Netherlands and because, "for identification purposes within morphologically well-distinguishable species groups, such as the genus *Hydrocotyle*, genetic variation is not an insurmountable issue, as the main problems will be to discriminate between the closely related taxa."

Van de Wiel et al. found that sequencing one variable chloroplast locus, *trnH-psbA*, was sufficient for distinguishing a noxious invasive plant from a series of closely related congeners. The authors' hope is that "this could be helpful with enforcing a ban on import of such invasives, such as is already in place in the Netherlands."

Xiong, W., Yu, D., Wang, Q., Liu, C., & Wang, L. (2009) A Snail Prefers Native over Exotic Freshwater Plants: Implications for the Enemy Release Hypotheses. *Freshwater Biology* 53(11):2256-2263

One of the widely accepted theories used to explain the success of invasive plants is the enemy release hypothesis (ERH). To test the ERH, the researchers assessed the palatability of 20 native and 7 exotic plants to *Radix swinhoei*, a generalist herbivorous snail, itself native to Lianzi Lake in Hubei Province, China.

In this study the authors predicted, according to ERH hypothesis, that (i) snails would prefer native over exotic species in a phylogenetically paired assay (eight pairs) and (ii) snails would prefer native over exotic species in a lake where all occurred. In all eight feeding assays, *R. swinhoei* showed a significant preference for the native over the exotic species in seven of the eight matched taxonomic pairs. The authors conclude, "Exotic plants in our study were less palatable than native plants, suggesting that exotics have a potential advantage in invading lakes and wetlands in this area, and perhaps elsewhere."

Florida Research Newsletter

The Florida Fish and Wildlife Conservation Commission (FWC) Invasive Plant Management Section's Research and Outreach Program publishes a research newsletter to help resource managers in Florida stay informed about current FWC contracted research and outreach in invasive plant management. The [FWC Invasive Plant Management Research and Outreach Program Newsletter](#) is compiled by Don C. Schmitz, Research Program Manager, Invasive Plant Management Section, Florida Fish and Wildlife Conservation Commission in Tallahassee, Florida. Don.Schmitz@MyFWC.com

FloraGator—a new multiple-entry key to the flowering plant families of Florida

By Niels Proctor and Dr. Sandra Wilson

How do you identify an unknown plant? There are formal means and informal means of plant identification, and—if you're anything like the rest of us—you probably start with the informal means. You ask the guy across the hall. You flip through some plant books to find something similar. Maybe you Google “purple flowers and opposite leaves” to see if you get lucky. Sooner or later though, if you really want to identify the mystery plant in your hand, you'll need to give up on the half-hearted approach and turn to that traditional tool of plant identification: the single-entry, dichotomous key.

For at least a few centuries, written botanical keys have been the standard method of identifying unknown plants. Such keys are “single-entry” because they expect you to start at a particular point (Question 1) and they are “dichotomous” because they present a choice of precisely two options at each and every step. When you use a key of this kind, you are led through a series of (hopefully) clear-cut choices until, by giving a series of (hopefully) accurate answers, you eventually arrive at the correct identification.

Written keys have some fairly obvious benefits. They are cheap to make and easy to reproduce. They are exceedingly portable and easy to replace. And they carry the benefit of expert guidance. When you use a dichotomous key, you are being led by the unseen hand of some expert botanist who has selected the most distinctive and reliable features of the plant for identification. The disadvantage of such a key is that it can't possibly cover all the plant ID problems that come up in real life. What if you reach a question about flowers, but the plant you're holding isn't in bloom? Or what if there's a question about leaves but you're only holding a flower that someone picked and brought in to your office? Dichotomous keys can also be very slow ways to identify some unusual plant that could be identified in moments if someone asked the right questions about a few distinctive features.

To address all of these problems, botanists began experimenting a few decades ago with a new kind of identification tool: a “multiple-entry” key that collects information without any particular order or starting point. The first such keys, produced in the 1960s, were simple (but clever) punch card affairs. They allowed a user to line up a series of holes punched through index cards to see which plants matched certain combinations of features. The card stacks were effective tools for identification, but they were bulky to carry and expensive to produce and they never really caught on.

A newer generation of tools, produced around the turn of the century, were computer programs that could compare a list of plant features with a database of species descriptions. These programs brought enormous potential for botanical research, and they are still being used and developed. Their primary limitation is that

they require the user to download and install a particular piece of software. The newest identification tools, that are just beginning to come online, are web-based, multiple-entry keys. These keys don't require any special software apart from a normal web browser, and they are available to anyone with an internet connection.

As part of the environmental horticulture program (funded through a mini-grant within the College of Agricultural and Life Sciences), we have begun to develop one such web-based, multiple-entry key to let botanists identify unknown plants to the family level. We call our key “FloraGator” and we are programming it to cover all 189 of the flowering plant families found in the natural areas of Florida. The site allows a user to enter information from a list of 220 flowering plant characteristics and receive a list of the corresponding families that display those features. By steadily entering more and more information about a plant, a user should be able to narrow down the list to a single family.

Because FloraGator is a multiple-entry key, there is no “hidden botanist” guiding the user to the most distinctive or useful features for identification. This may make the key harder to use for some beginners, but our hope is that it also makes the key a better educational tool. Students who use the site become active plant investigators, applying their new botanical terminology and searching for clues to a correct identification. And, along the way, they learn which features are most useful and powerful for reaching that correct ID. (To help students practice these plant identification skills, we've included several old botanical illustrations as part of the site.)

Multiple-entry keys are going to become more common in the near future, and they're also likely to make the jump from computers to cell phones. Our lab is actively pursuing grant funding to convert FloraGator from a web site to a smart phone app. Once we make that transition, a plant enthusiast anywhere in the state will be able to pull out a phone, enter some information, and quickly identify a plant to the family level. It will be a neat (and fun) bit of technology, and we hope it will be considerably more reliable than asking that guy down the hall.



Can you help us test FloraGator?

FloraGator is primarily intended to be a teaching tool for students of botany and plant systematics. We hope that it will give users an active role in collecting information and applying terminology. But, to be sure it works, we need to do some testing.

To help us out, please go to this URL: <http://hort.ifas.ufl.edu/floragator/>

Key out a plant (or two) and send us your results. We would love to hear how it worked and get any suggestions you have for improvements.

APIRS, *continued from page 1.*

continued to expand the scope of bibliographic coverage, now adding upland invasive plants in Florida to the collected citations.

The database was eventually reprogrammed by a University of Florida computer-science student as part of his senior project (at no cost to us). Data entry improved remarkably but searching APIRS is still complex and still, essentially only two people are adept at using the database to its full potential. Colorful stamps have been replaced by e-mail messages with file attachments, and correspondence has become swift and brief.

Although amazing developments on the Internet have streamlined the process of building the APIRS collection, we struggle to align our mission with the overwhelming availability of

literature on the web while keeping within our very limited budget. The volume of literature is astoundingly large and widely dispersed in a myriad of journals, proceedings, websites, blogs, books, newsletters, and grey literature over the entire globe. Numerous research interconnections exist (invasion theory, plant physiology, phytosociology, taxonomy, genetics, management, etc.), creating a bewildering variety of possibilities. We try to remember who funds our work (the state of Florida). Do we confine our collections to problem species in Florida? What about research from the native ranges of invasive species in Florida? Or invasive plant research in similar latitudes or neighboring states? Modeling, economic impacts, management theory, screening and prevention studies? We struggle to keep pace with these developments, and wish for updated

programming to bring APIRS closer to current standards. In addition, there is a broader Information Office to run.

While all universities in the United States have experienced budget cuts and changes in direction over the past several years, we continue moving forward to provide information to researchers, managers, and educators to assist in their work. The Center is an integral part of the University of Florida's IFAS extension, research and teaching program. We will keep you posted on the Information Office and APIRS database efforts with issues of AQUAPHYTE, now in its 30th year. In the meantime, please continue to send us your research articles, books, conference proceedings, and an occasional greeting from your part of the world—and please let us know if we can assist you. That part of our mission is unchanged.

A Q U A P H Y T E

AQUAPHYTE is the newsletter of the Center for Aquatic and Invasive Plants (CAIP) and the Aquatic, Wetland and Invasive Plant Information Retrieval System (APIRS) of the University of Florida / Institute of Food and Agricultural Sciences (UF/IFAS). Support for CAIP is provided by the Florida Fish and Wildlife Conservation Commission, Invasive Plant Management Section, and UF/IFAS.

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AQUAPHYTE is sent to managers, researchers and agencies in 71 countries around the world. Comments, announcements, news items and other information relevant to aquatic and invasive plant research are solicited.

Inclusion in **AQUAPHYTE** does not constitute endorsement, nor does exclusion represent criticism, of any item, organization, individual, or institution by the University of Florida.

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Aroma (Dichrostachys cinerea subspecies africana) is readily available in the international, national, and local trade. It is touted on the Web as an interesting specimen for the landscape, and an appealing bonsai species. Photo by C. Jacono, March 2010. See article on page 3 of this issue.